

THE EARNING POWER OF INPUTS AND INVESTMENTS ON MONTGOMERY COMMUNITY FARMS TRIGG COUNTY, 1951

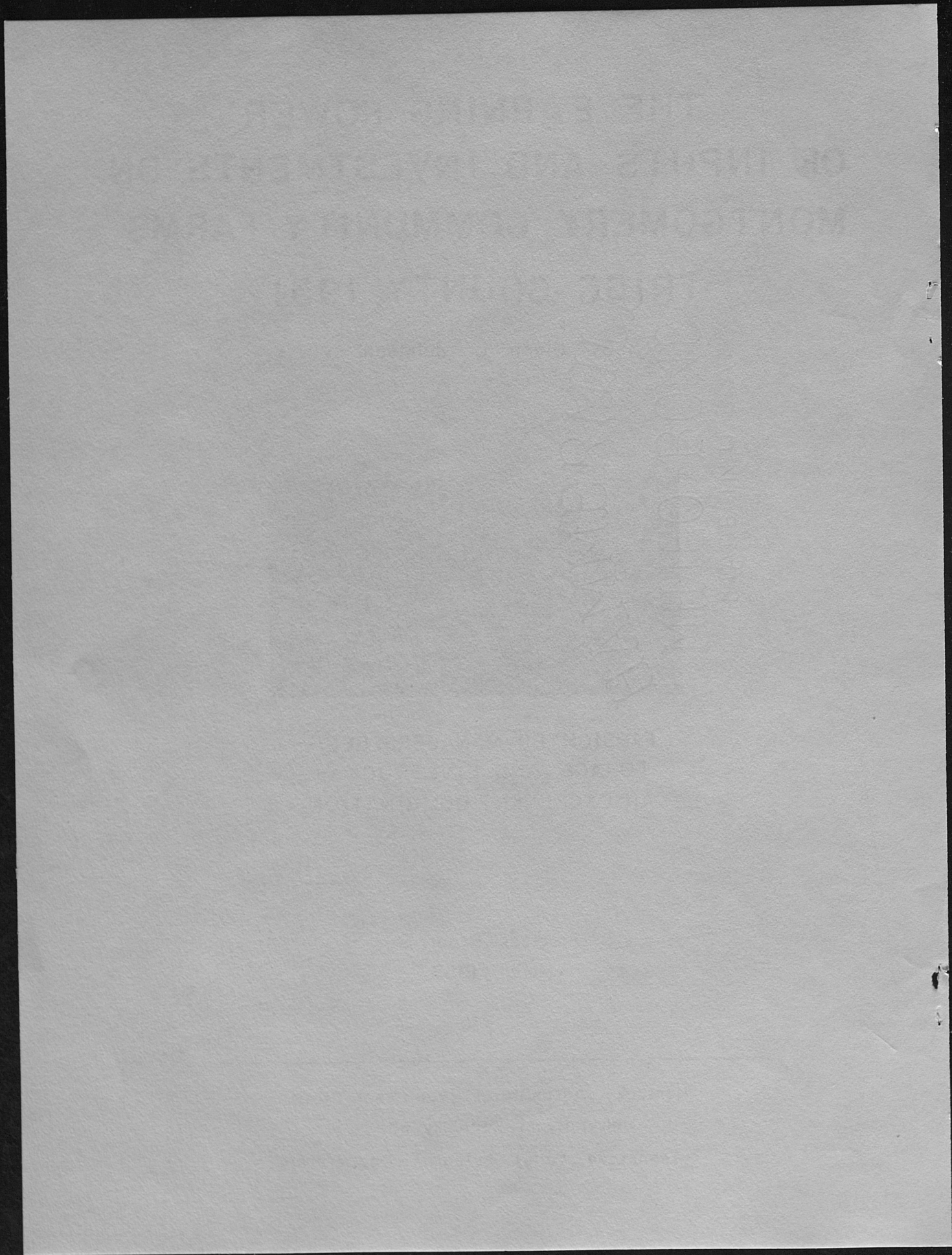
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FARSIGHTED MANAGERS SEE --
FORAGE AND LIVESTOCK --
AN EXCELLENT COMBINATION

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INTRODUCTION

As part of a study designed to estimate the earning power of different investments and inputs on western Kentucky farms, financial records from 30 eastern Trigg county farms were gathered and analyzed. The records were for the calendar year 1951 and the farms involved were upland farms located mainly on Decatur and Hagerstown silt loam soils in or near Montgomery community in the eastern part of the county. As these farms are more or less representative of Pennyroyal Plains farms on Decatur and Hagerstown soils, this report should be of interest as far east as Bowling Green.

Farm business records can be analyzed in several different ways. For instance, individual enterprises such as the beef, hog and tobacco enterprises could be examined separately and in detail. Or, individual inputs such as combines, milking machines, silos, and ladino clover seed could be studied.

Still another important way to think about farm organizations is to think about the earning power of major groups of inputs or types of investments. This is the method followed in this report. Farmers are thinking in such terms when they speak of investing in livestock, grass land farming or machinery. They are also thinking in such terms when they speak of a particular farm being "over-built" because they feel the farm they are thinking of has too much invested in buildings. Similarly, the "land-poor" farmer is conceived to be one who has over-extended his land-holdings in relation to other investments such as those in livestock and machinery. Bankers, P. C. A. officials, F. H. A. officials and other people extending credit to farmers also think about groups of inputs and investment. One loan is extended for the purpose of investing in machinery, another for establishing forage stands, another for purchasing livestock -- still another for operating expenses, etc.

Farm leaders, legislators, etc., also think in such terms. Thus, the Kentucky "Green Pastures" program came into being in order to point out the profitability of investments in forage production. Similarly, the Federal Land Banks were established to deal with investments in land while the Soil Conservation Service was set up to deal with the preservation and maintenance of the soil resources. In Montgomery community, the U. K. Extension Service and T. V. A. have been cooperating in a Test Demonstration program designed to acquaint farmers with the profitability of fertilizer and associated seed and livestock investments.

Advantages of Analytical Methods Used

A modern method of analyzing the records from the 30 farms was used in estimating the earning power of land, labor, forage-livestock investments, machinery investments and other expenses. This method, which was partially developed by the present Senator Douglas from Illinois, is referred to as the Cobb-Douglas method. Cobb was the mathematician who aided Douglas. This method has four main advantages over older methods of farm-record analysis. These advantages are as follows:

- (1) It permits diminishing returns due to size of operation and lack of balance in a farm business to be reflected in the estimates of earning power.
- (2) The estimates of earning power refer to the gross income produced by the last unit of the input used; such estimates are particularly useful because a farmer considers the earning power of what he is going to add or subtract instead of the average earning power so commonly estimated.
- (3) It permits the earning powers of the separate inputs and investments to be estimated simultaneously without assuming the earning power of the other inputs. In short, data from actual farm businesses determine the earning power estimates, rather than having the estimates partially determined by the assumed earning power of the other inputs in investment.
- (4) Lastly, the method yields estimates reflecting the effect of changes in the earning power of one investment or input on the earning powers of other investments and inputs.

The Date Secured On Each Farm Business

The 30-farm survey records from the Montgomery community were analyzed in the over-all terms previously discussed and by the Cobb-Douglas technique. Six figures were secured for each farm:

- (1) Gross income includes the value of all products produced on the farm including the value of products consumed in the home. The rental value of the farm home, however, was not included.
- (2) Land inputs were measured in acres. All land was included whether or not developed, as it is difficult to distinguish in a non-arbitrary way between land capable of being developed for crop or forage production and land completely unfit for grain or forage production.
- (3) Labor inputs were measured in months of labor on the farm per year which was available for productive use regardless of the efficiency with which it was used. One object of the study was to find out how efficiently labor was being used. As in the case of land, the distinction between idle labor and productively employed labor is somewhat arbitrary and difficult to make.

- (4) The forage-livestock investment includes the replacement value of all preennial pasture and hay stands, plus the value of the beginning livestock inventory with proportional credits for livestock sold off the farm and proportional charges for livestock purchased during the year.
- (5) The machinery investment was the current value of the machinery, tools and equipment on hand at the beginning of the year, plus proportional additions and deductions for machinery purchased and sold during the year. Each farmer was asked to evaluate his items of machinery separately.
- (6) Other expenses include the amounts actually paid for annual seeds; gas; oil; fertilizers whose values are consumed in one year; fee; supplies; custom work; and negative changes in the inventory value of purchased feed, seed, etc. Expenditures on maintenance of land, machinery investments, and the forage-livestock investments were not included; neither were depreciation charges on these items.^{1/}

KINDS OF FARMS STUDIED

In general, the farms studied were large productive farms comparing favorably with the best in the nation. Gross incomes on these farms ranged from a high of \$49,677 down to a low of \$1,852. The acreages involved ranged from a low of 41 to a high of 860 acres. One farmer used only 6 months' labor while another used 96 months. Forage-livestock investments, among the farms studied, varied from a low of \$838 to a high of \$42,115. Machinery investments also varied widely, the smallest being \$1.00 and the largest being \$28,782. Similarly, other expenditures ranged from \$483 to \$8,561.

The "usual" farm among those studied can be described better with geometric rather than common averages. This is so because a geometric average gives proportionally less weight to the few large farms included in the sample and thus tends to be more representative of the majority and in the sample. Geometric average amounts will be referred to as "usual" amounts, and a hypothetical farm having usual amounts of investments and inputs will be referred to as the usual farm studied.

^{1/} Due to the difficulty of determining correct depreciation rates as maintenance expenses are varied, it is thought best to eliminate these charges. This means that the earning power of machinery, land, and forage-livestock investments must cover such charges.

The "Usual" Farm
Studied

The usual farm studied had the following input and investment pattern:

Land-----	231.5 acres
Labor-----	24.6 months
Forage-livestock investment-----	\$8,996.
Machinery investment-----	\$3,109.
Other expenditures-----	\$2,596

**EARNING POWERS ON
THE USUAL FARM STUDIED**

The usual combination of inputs and investments described in the preceding section produced a gross income (excluding the rental value of the farm home and the cost of feeder stock purchased) of \$10,259.

It is not enough to know the over-all earning power of a group of investments. If farm organizations are to be appraised and profitably replanned, information on the earning power of groups of separate inputs and investments are needed. Still further, a special type of estimate is needed. The earning power of the last unit used of each group of investments or input needs to be known.

Estimates of average earning power are inadequate. A farmer might average \$200 a month for all labor used; yet the last month used might add only \$25 to gross income. In adding or subtracting inputs and investments, it is the earning power of the last unit used which counts. The question is, "Does the earning power of the last unit used exceed its cost?" As long as it does, profits can be increased by adding more of the input even if, as is generally the case, the addition lowers the earning power for the next unit to be added. Throughout this report, the term, "earning power," refers to the earning power of the last unit used--average earning powers are usually higher.

The Earning Power
Of Labor on the Usual Farm

Additional labor beyond the 24.6 months of labor used, it is estimated, would have earned about \$66 a month when used in connection with the amounts of other inputs and investments usual for the farms studied. A reduction in the amount of labor used to 15 months, it is estimated, would increase its earning power to over \$100 a month. This increased earning power would result from the necessity for using labor more effectively as the amount is reduced.

As the large farms in this community are productive, labor has worthwhile things to do and its marginal earning power can be increased by saving it. Farm work simplification techniques, therefore, should be expected to be more helpful in reorganizing these farms than in reorganizing less productive farms, i. e., it pays to save labor when labor has productive alternative uses.

The Earning Power of
Land Inputs, Forage-
Livestock Investments
And Other Expenditures

These three inputs and investments were yielding good returns when considered jointly and when used in the combinations usual among the farms studied. An additional acre of land, an additional \$40 investment in seeding, an additional \$150 investment in livestock, and an additional \$20 in current expenses, it is estimated, would add around \$150 to gross income. When it came to estimating the separate earning powers of these investments and inputs, however, some difficulty was encountered. This difficulty arose because the amounts of land, forage-livestock investment and other expenses used tended to change together from farm to farm. This close relationship increased the chances of error in the computations and made it necessary to interpret the estimates rather carefully.

The estimated earning power of the forage-livestock investment is 69 percent per dollar per year. The chances are one out of three that in a given year there might be an error in this estimate as large as 12 percent above or below this figure. The estimated earning power of raw land is a minus \$3.09 per acre per year, with a one in three chance of an error as large as \$8.00, above or below this estimate, occurring in a given year. It is the judgment of the author that the earning power of land is under-estimated; part of its earning power appears to be reflected in the estimated earning power of the forage-livestock investment. It is concluded, therefore, that the earning power of forage-livestock investments was actually between 50 and 60 percent in 1951 and that the earning power of raw land was actually between \$2 and \$7 per acre.

The earning power of other expenses was estimated at \$1.06 per additional dollar spent in the usual farm organization. As noted before, other expenses were used in amounts rather closely related to the land inputs and forage-livestock investments. This close relationship increases the chances of error in the estimate; however, no reason appears for suspecting that a bias exists in this estimate. Thus, the \$1.06 estimate is accepted as far as the forage-livestock investment and land inputs are concerned. However, as will be seen later, the estimated earning power of other expenses may reflect some of the earning power of machinery. Therefore, it is concluded that the earning power of other expenses was about a dollar for a dollar in 1951 for the usual farm studied.

The Earning Power of
Machinery Investments

The earning power of machinery was estimated at 2.7 percent per dollar invested, the chances of an error as large as \pm 12.5 percent occurring in a given year being one out of three. Though the amount of machinery used was not closely related to amounts of other inputs, it appears that the 2.7 percent estimate is lower than the actual earning power of machinery in 1951. Probably some of the earning power of machinery was reflected in the estimated earning power of other expenses, labor, and land. Of the estimates for these three inputs, only the estimated earning power for other expenses appears high. It is concluded that the actual earning power of machinery was probably higher than the 2.7 estimate -- a reasonable range appears to be from 5 to 15 percent.

A Summary Statement
Concerning the Earning Power
Of Different Investments and Inputs

Conclusions from the above discussions can be summarized in specific terms as follows:

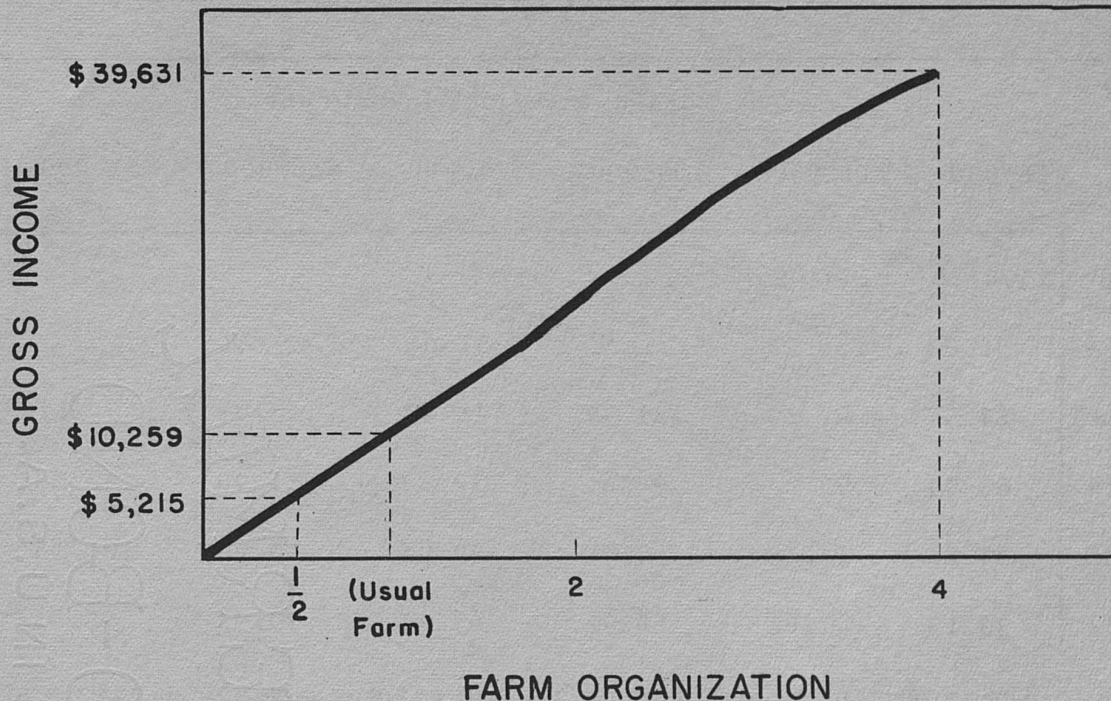
Investment or Input	Usual Amount	Conclusions as to the Earning Power of Last Unit Used
Land	231.5 acres	\$2 to \$7 an acre
Labor	24.6 months	\$66 a month
Forage-livestock	\$8,996	50 - 60 percent
Machinery	\$3,109	5 - 15 percent
Other expenses	\$2,596	\$1.00 per dollar

SIZE OF OPERATION AND EFFICIENCY

One advantage of the estimating methods used in analyzing these records is that it permits diminishing returns as actually encountered by farmers to be reflected in the estimates. For the 30 farms studied, the estimates indicate that a doubling of all inputs and investments would not result in a doubling of gross income. To state this same thing differently and more specifically, the estimates indicate that a 100 percent increase in the use of all inputs would increase gross income by 96.7 percent.

The usual farm studied was a relatively large one involving 232 acres of land and capable of producing over \$10,000 worth of products at 1951 prices with relatively high returns to each investment or input. Thus, the law of diminishing returns is not imposing serious limitations on size of farms in the upland Montgomery community of Trigg county.

For a farm one half as large as the usual farm, but similarly organized, estimated gross income was \$5,215 as compared with the usual farms' gross income of \$10,259. A farm four times as big as the usual farm and similarly organized would be expected to earn only \$39,631. All of these estimates, of course, apply to 1951 prices and weather conditions.



ORGANIZATION AFFECTS EARNING POWER OF LABOR AND FORAGE-LIVESTOCK INVESTMENTS

Though most of the farms studied had good over-all organization from a long-run standpoint, gross and net incomes from many of the individual farms studied could have been increased by reorganization. Under the favorable beef prices which prevailed in 1951, most of the farms did not have enough money invested in forage and livestock and many of them probably used too much labor. Even if favorable 1951 beef prices are discounted, several farms were long on labor and short on forage-livestock investments.

The earning powers of both labor and forage-livestock investments depend on both the amounts and proportions used. The following charts 1/ are helpful in seeing the nature of these relationships:

1/ These charts are based on the raw unadjusted estimates and hence may over-estimate the earning power of forage and livestock investments by as much as 10 percent. No reason exists for suspecting that the earning power of labor is biased.

THE EARNING POWER OF LABOR
(Dollars Per Last Month Used)

		The Forage-Livestock Investment					
		\$6,000	\$11,000	\$16,000	\$21,000	\$26,000	\$31,000
MONTHS OF LABOR USED	6	\$170.26	\$244.99				
	12	95.03	136.75	\$171.27	\$201.66	\$229.24	
	18	67.57	97.23	121.77	143.38	163.01	\$181.17
	24	53.04	76.34	95.61	112.57	127.98	142.23
	36	37.72	54.28	67.98	80.04	90.99	101.13
	42	33.13	47.68	59.71	69.92	79.93	88.83

The important thing to note is how the earning power of labor changes (1) as the amount of labor used changes and (2) as the amount of supporting forage-livestock investment changes.

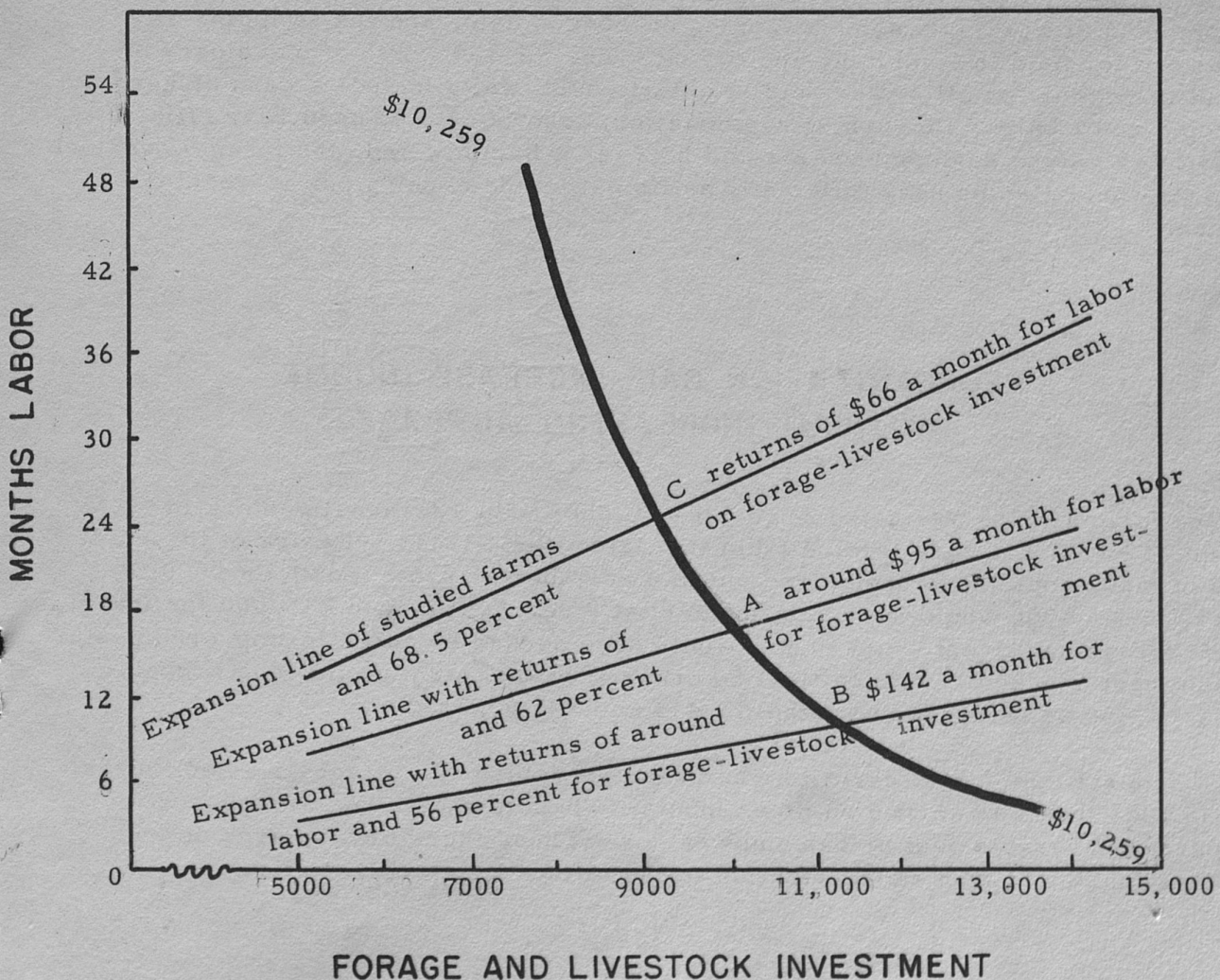
THE EARNING POWER OF FORAGE-LIVESTOCK
INVESTMENTS
(Percent Gross Return on Last Dollar Used)

		The Forage-Livestock Investment					
		\$6,000	\$11,000	\$16,000	\$21,000	\$26,000	\$31,000
MONTHS OF LABOR USED	6	64%	50%				
	12	71.84	56.39	48.55%	43.56%	39.99%	
	18	76.61	60.14	51.78	46.45	42.65	39.76%
	24	80.20	62.96	54.20	48.63	44.65	41.62
	36	85.54	67.14	57.81	51.86	47.62	44.39
	42	87.66	68.81	59.25	52.86	48.80	45.49

Here again, the important thing to note is how the earning power of forage-livestock investments change (1) as the amount of forage-livestock investment used changes and (2) as the amount of supporting labor used change

The "proper" combination of labor inputs with forage-livestock investments depends on the rates of return which a particular farmer feels he must have for them. It is common knowledge that any given gross income can be obtained from many different combinations of labor inputs and forage-livestock investments. Those combinations using high proportions of labor use labor inefficiently, and forage-livestock investments efficiently. As such, they are useable by the farmer with an ample supply of cheap labor but demanding a high return for his forage-livestock investments. On the other hand, those combinations using small proportions of labor and large proportions of forage-livestock investments use the forage-livestock investments less efficiently and labor very efficiently. Such combinations are for the farmer with a restricted supply of expensive labor but willing to make investments in forage and livestock at moderate rates of returns. These conclusions can be checked by consulting the two tables on page 8.

How the necessary returns to labor inputs and forage-livestock investments affect the "proper" combinations of the two is shown in the following chart. The curved line on this chart shows different ways of combining labor with forage-livestock investments to earn \$10,259 gross income on the usual farm studied without changing other inputs and investments.



The straight line going through point C is the line along which the farms studied tended to be grouped--at point C the estimated earning power of forage-livestock investment was 68.5 percent (unadjusted) and the labor earning power was \$66 a month. Had farmers been willing to make forage-livestock investments at a 62 percent return and willing to use labor at \$95 a month, they would have followed the straight line going through point A. Along this line about \$567 is invested in forage and livestock for every month of labor used; along the line actually followed, which goes through point C, \$366 were used with each month of labor.

Labor is becoming more and more expensive as a result of being scarcer. Thus, it is interesting to inquire concerning the proportions in which forage-livestock investments and labor should be combined to produce the usual income of \$10,259 if labor is expected to earn, say over \$140 a month and the forage-livestock investment is expected to earn, say 55 percent. At point B, about 12 months of labor and about \$11,000 invested in forage and livestock would have earned \$10,259 gross; \$11,000 would cover 40 acres of improved pasture at \$40 an acre, 100 acres of lespedeza, redtop and timothy worth \$10 an acre and stock it with 40 head of cows. These forty head, with some feed from the remainder of the farm, could produce forty 500 pound calves annually worth \$.25 a pound (in 1951) for a total of \$5,000. The remainder of the farm could produce 2 acres of burley for a gross of \$1,600. Fescue seed from 40 acres plus small grain and corn from 60 acres would take gross income on up to around the \$10,259 mark at 1951 prices. This gross income could be produced with 12 months of work with some swapping of tobacco help, and the swapping of custom work for help in combining and haying. The \$3,109 worth of machinery on the usual farm (part or all 2 years old or older) could easily include a corn picker and a combine or baler. In such an organization, labor would be used very efficiently--in fact, its estimated earning power would be \$142 a month. And, the forage-livestock investment would also be used efficiently as its estimated earning power would be 56 percent.

REORGANIZATION CAN INCREASE INCOME WITHOUT INCREASING ACREAGE

One farm studied was using 24 months of labor with a forage-livestock investment of \$1,371. Gross income from this farm was \$3,443. Twelve of these 24 months of labor could have been hired out to a neighbor at \$75 a month or \$900 for the year. That \$900 would have paid interest at 8 percent or over \$10,000 for investments in forage and livestock; \$10,000 would have seeded 80 acres to improved pasture and would have stocked it with cattle. So organized, this farm would have probably grossed \$7,350 as compared with the \$3,443 actually grossed.

In general, the farms earned higher rates of returns on forage-livestock investments in 1952 than was earned on other inputs. These high returns were based in large part on favorable beef prices and weather. Thus, these high returns do not call for as much long-run reorganization in the forage-livestock direction.

as comparable returns would call for in an area securing such returns from stable milk prices. However, even when the high returns to forage-livestock investments are heavily discounted, it is apparent:

1. that few, if any, of the farms had over expanded their forage livestock investments,
2. that many of the farms are well organized but
3. that several of the farms could be reorganized to use more forage and livestock and relatively less labor,
4. that the U. K. -- T. V. A. extension programs, the Green Pastures programs and the S. C. S. programs generally are sound in placing heavy emphasis on land development, forage production and livestock.

1947 AND 1951 COMPARED

A farm and home survey made in 1947 and repeated in 1951 shows that for some time the farmers of Montgomery community have been moving in the directions indicated to be profitable in this report. ^{1/} In all, 14 farms were covered in this survey -- 8 medium sized and 6 large ones. In the four-year period, the following trends were noted in the organization and operation of these farms:

- (1) More fertilizer was used with potash increases being the largest. Increased application of commercial nitrogen to new seedings and pasture sods also occurred. Phosphate increases were smaller as most of the farms surveyed had made heavier earlier applications of phosphates.
- (2) Forage-consuming livestock was greatly increased. The number of beef cows kept, however, decreased the loss, being more than made up with fat cattle. Declines in dairy cattle and sheep numbers also occurred.
- (3) The larger farms shifted from row crop to forage crop acreages.
- (4) Farm machinery investments increased. More combines were used in 1951 to handle larger small grain and fescue seed acreages than existed in 1947. Corn pickers were also used more extensively in 1951.
- (5) Living conditions also improved. Six of the fourteen farms added electricity between 1947 and 1951 which gave all 14 electricity in 1951. Bathrooms were added on four farms and the number with running water was increased from 4 to 6. Electric refrigerators, electric ranges, modernized kitchens and home freezers came into general use. Churches and schools also improved and the 14 farmers concerned made major contributions to a new county hospital.

^{1/} This survey was conducted by U. K. extension agents working in the area in cooperation with Montgomery community test-demonstrators.

GOOD LIVINGS ARE AVAILABLE IN MONTGOMERY COMMUNITY TRIGG COUNTY

Blessed with good Decatur and Hagerstown soils, the farmers of Montgomery community can make and many of them are making excellent livings. Many of the farmers surveyed had accumulated large quantities of assets. These assets tended to be well organized and were producing good incomes.

A few of the farmers studied had not yet accumulated the necessary assets. On these farms the main problem involved in expanding income is, of course, one of acquiring the use of assets through savings and judicious borrowing. Savings become possible as productivity is increased and/or consumption is restrained. Though the amount of assets used is important for the lower income farmers, organization of existing assets is very important. This is also true for those trying to save enough to make their total earnings exceed their expenditures. Earlier discussions in the report indicate that forage-livestock investments not only have high earning power, in and of themselves, but that they increase the earning power of other inputs and investments as well. Expansion of the forage-livestock investment to at least the proportions used by the "usual farm" is likely to be profitable on either large or small farms.

Dairying is probably safer than beef--especially for small farms. Further, dairying offers a market for relatively large amounts of labor usually found on small farms. Machinery investments appear less profitable. More land does not appear profitable enough to be purchased until existing land holdings are rather fully developed.

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The benefits to be reaped from developing a substantial farm business are great. Ownership of an improved productive farm is a source of community respect, security, family stability and a good standard of living. Only a small proportion of urban laborers are ever able to command the important things of life to the extent they are commanded by persons owning good productive farms.